Phase-Boundary Catalysts for Acid-Catalyzed Reactions: The Role of Bimodal Amphiphilic Structure and Location of Active Sites

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ABSTRACT

The catalytic potential of phase-boundary catalyst for acid-catalyzed reactions has been demonstrated by NaY zeolite loaded with alkylsilane-covered niobic acid in the liquid phase hydration of 1,2-epoxyoctane with water. The catalyst was prepared by impregnation of niobic acid on the external surface of NaY and followed by a partial modification of the external surface of NaY with alkylsilyl groups. When the particles were added to a mixture of water and 1,2-epoxyoctane, they were feasibly located just at the liquid-liquid phase boundary and efficiently catalyzed hydration of the epoxide even without stirring. In order to investigate the effect of the location of the active sites, alkylsilylated HZSM-5 and sulfonic acid functionalized NaY in which the active sites are located dominantly on the internal surface of zeolites were prepared. In that case, mechanical stirring was needed to increase the reaction rate. It was suggested that alkylsilylation on the external surface of zeolite, when the active site is mainly inside the pore, could not change the mode of the catalytic action; it is still necessary to stir the reaction mixture to drive the mass transfer of substrates and reagents.